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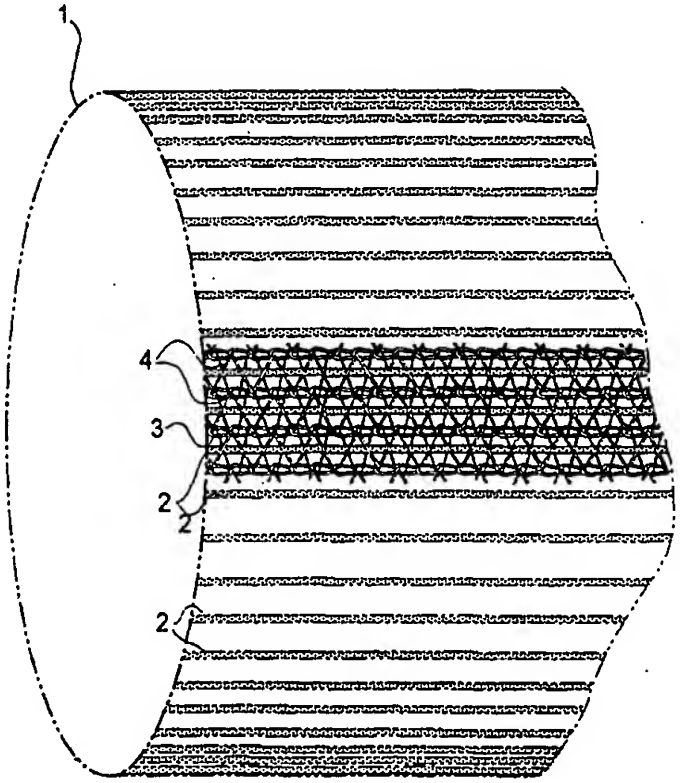
(54) Title: LAID-YARN FABRIC

(57) Abstract

The invention relates to a laid-yarn fabric serving as a reinforcement material in the manufacture of fibre composites, and comprising a connecting thread system and reinforcement threads (2) inserted into said thread system. The laid-yarn fabric forms a transversely elastic tube-like means (1) which is arranged to be passed over a core in order to form or to be comprised in said fibre composite. The invention likewise concerns a method of producing preforms for the manufacture of fibre composites, using such a transversely elastic, tube-like laid-yarn fabric. The laid-yarn fabric is applied on a core by the tube-like means (1) being passed over said core in such a manner that said tube-like means (1), on account of its transverse elasticity, drapes itself closely about said core. The laid-yarn fabric is then injected with thermosetting plastics, alternatively is heated, if the fabric is made from thermoplastic hybrid yarns.



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LAID-YARN FABRIC

Field of Invention

The present invention relates to a laid-yarn fabric serving as a reinforcement material in the manufacture of fibre composites, and comprising a connecting thread system and reinforcement threads inserted into said thread system.

The invention likewise relates to a method of producing preforms for the manufacture of fibre composites according to which method the laid-yarn fabric is deposited on a core and is injected with thermosetting plastics, alternatively is heated, when the fabric is made from thermoplastic hybrid yarns.

Technical Background

In the manufacture of fibre composites it is known to use laid-yarn fabrics consisting of a connecting thread system in which are inserted reinforcement threads of e.g. polymer materials, metal or glass fibres or a mixture of such materials. To produce a fibre composite one or several laid-yarn fabrics are draped on a core and shaped to the core geometry, whereupon a thermosetting plastics is applied on the fabric or fabrics and allowed to set. Alternatively, when the fabric is made from a thermoplastic hybrid yarn, heat is supplied to the laid-yarn fabric. In both cases the reinforcement threads serve as reinforcement in the finished fibre composite. It is essential that the laid-yarn fabric is pliable and shape-adaptable so as to narrowly follow the contours of the core to ensure that the finished fibre composite will closely resemble the shape of the core.

A drawback found in prior-art laid-yarn fabrics is that they may be difficult to drape about a core of

irregular shape, such as an elongate shape comprising one or several protrusions or depressions.

This drawback is particularly noticeable in multiaxial laid-yarn fabrics, i.e. in laid-yarn fabrics comprising several layers of reinforcement threads running in different directions relative to one another. The multiaxial laid-yarn fabrics are advantageous inasmuch as they exhibit excellent tensile strength in all directions, but disadvantageous because of their poor drapability.

Summary of the Invention

The object of the invention thus is to provide a laid-yarn fabric exhibiting satisfactory drapability also with respect to irregularly shaped cores, and a method employing the inventive laid-yarn fabric in order to produce preforms for the manufacture of fibre composites. The object is also to provide a method by means of which satisfactory tensile strength in several directions is obtained in the composite formed on the core while at the same time the ability to closely imitate the shape of the core is maintained.

The first-mentioned object is achieved in accordance with the teachings of the invention by means of a laid-yarn fabric forming a transversely elastic tube-like means which is arranged to be passed over a core in order to form or to be comprised in said fibre composite. In the manufacture of a fibre composite by means of the inventive method the fabric is applied on the core in that the tube-like means is passed over the core in such a manner that the laid-yarn fabric, on account of its elasticity, drapes itself closely about the core.

Owing to the elasticity of the laid-yarn fabric in the transverse direction, the tube-like means clings closely to the core, adapting itself to and adopting the shape of the core without creasing, also when used on cores of irregular shapes.

In accordance with one embodiment of the laid-yarn fabric the reinforcement threads are arranged essentially in parallel with the longitudinal extension of the tube-like means.

In accordance with another embodiment, the reinforcement threads are arranged at an angle to the longitudinal extension of the tube-like means.

In accordance with yet another embodiment, the reinforcement threads run in a zigzag pattern in the longitudinal extension of the tube-like means.

The maximum tensile strength of the fabric is in the direction of the reinforcement threads, for which reason these various embodiments offer possibilities of adaptation to different tensile-strength needs in different directions relative to the longitudinal direction of the tube-like means.

In accordance with a fourth embodiment of the laid-yarn fabric the connecting thread system or the reinforcement threads consist of thermoplastic hybrid yarns.

A second embodiment of the inventive method consists of applying at least two laid-yarn fabrics, both in the form of elastic tube-like means, the reinforcement threads of which run at different angles to one another and at an angle to the longitudinal axis of the respective means, on top of one another such that the tube-like means together form a multi-layer fabric wherein the reinforcement threads of one of the fabrics cross those of the other fabric about the core.

The multi-layer fabric applied on the core exhibit the same advantages as a multiaxial fabric, because the reinforcement threads therein run in different directions relative to each other. In consequence of the tube-like means being applied on the core one by one, the pliancy and shape-adaptability properties of the inventive multi-layer fabric are, however, greatly improved. The method provides a composite which exhibits tensile strength in

all or in desired directions, while retaining excellent properties of imitation of the core shape.

Brief Description of the Drawings

Fig. 1 illustrates the lay-out of the thread system and the reinforcement threads in accordance with one embodiment of the tube-like means of the invention.

Fig. 2 is a view on an enlarged scale of the arrangements of the thread system and the reinforcement threads according to this embodiment of the invention.

Fig. 3 is a view, likewise on an enlarged scale, of the arrangements of the thread system and the reinforcement threads in accordance with a second embodiment of the invention.

Fig. 4 is a view, likewise on an enlarged scale, of the arrangements of the thread system and the reinforcement threads in accordance with a third embodiment of the invention.

Fig. 5 is a schematic representation of a laid-yarn fabric in accordance with the invention imagined to be passed over a core, the diameter of which varies along the core length.

Description of Preferred Embodiments

Fig. 1 illustrates one embodiment of the tube-like means in accordance with the invention. A laid-yarn fabric forms a tube-like, in the subject case cylindrical, elastic means 1, see also Fig. 2, constructed from reinforcement threads 2 and a connecting thread system consisting of wales 3 and interlacing threads 4. The reinforcement threads 2 are arranged so as to extend essentially in parallel with the longitudinal direction of the tube-like means 1 between the wales 3 that extend in the same direction as the threads 2, and they are maintained in this inter-wale position by means of the interlacing threads 4.

Fig. 3 illustrates a part of a tubular means in accordance with another embodiment of the invention as deployed into a flattened condition. In this case, the connecting thread system of the fabric comprises parallel, spaced apart wales 3 and interlacing threads 5, 6. In each space or gap between the wales 3 an optional number of reinforcement threads 2 may be inserted. In accordance with the embodiment shown in this drawing figure, two reinforcement threads 2 are chosen, like in the first embodiment, said threads extending in parallel relationship with each other and with the wales 3. A bottom interlacing thread 5 extends in a zigzag pattern intermediate the wales 3 on one side of the reinforcement threads 2 and a top interlacing thread 6 extends in the same zigzag pattern on the opposite side.

A laid-yarn fabric as constructed in accordance with Fig. 2 possesses the advantage of being of comparatively simple structure while at the same time imparting to the tube-like means manufactured from laid-yarn fabric, satisfactory elasticity in the transverse direction, i.e. crosswise relative to the extension of the reinforcement threads 2. A laid-yarn fabric manufactured in accordance with the embodiment of Fig. 3, although requiring a larger number of stitch-forming machines (knitting machines), offers the advantage of exhibiting increased flexibility.

Both reinforcement threads 2 of each pair of threads may consist of the same or of different materials, for example a polymer material, metal or glass fibres.

In an enlarged view, Fig. 4 shows the structure of a laid-yarn fabric in accordance with a third embodiment of the invention. In accordance with this embodiment it is the reinforcement threads 2 that run in a zigzag pattern to interlace the wales 3 that are disposed in parallel relationship. In the tube-like means 1, this structure imparts reinforcement lengthwise as well as crosswise

while at the same time some movability is possible also lengthwise as a result of elongation of the wales 3.

All embodiments described in the aforegoing provide elasticity properties crosswise owing to the arrangement of the reinforcement threads 2 and the connecting thread system.

An elastic, tube-like means 1 in accordance with the invention, as draped about a core having varying thickness in its lengthwise extension, is shown schematically in Fig. 5. In this drawing figure, the tube-like means 1 is illustrated by longitudinal lines indicating the directions of extension of the reinforcement threads. The tube-like means is assumed to be positioned on an elongate core which is configured with a pronounced inwardly curved middle portion. On account of the elasticity of the tube-like means 1 in the transverse direction, said means clings to core, narrowly following the outline of the latter, thus imitating the shape of the core in the desired manner.

Several modifications are possible within the scope of the invention as the latter is defined in the appended claims. The reinforcement threads 2 may be arranged in several different ways in the tube-like means 1. For example, their angle to the lengthwise direction of the tube-like means 1 could be varied as could also the manner in which these threads are inserted in and interlaced with the connecting thread system. Reinforcement threads 2 may be used on the entire external face of the means 1 or merely on part thereof. In addition, the basic shape of the tube-like means 1, instead of being cylindrical, could be conical or otherwise adapted to the shape of the core. The elasticity of the means 1 could be achieved either by means of an elastic material, inserted into the fabric, or as a result of the very design of the connecting thread system.

CLAIMS

1. A laid-yarn fabric intended as a reinforcement material in the manufacture of fibre composites, and comprising a connecting thread system and reinforcement threads (2) inserted into said thread system, c h a r a c t e r i s e d in that the laid-yarn fabric forms a transversely elastic tube-like means (1) which is arranged to be passed over a core in order to form or to be comprised in said fibre composite.

2. A laid-yarn fabric as claimed in claim 1, c h a r a c t e r i s e d in that the reinforcement threads (2) are arranged essentially in parallel with the longitudinal extension of the tube-like means (1).

3. A laid-yarn fabric as claimed in claim 1, c h a r a c t e r i s e d in that the reinforcement threads (2) are arranged at an angle to the longitudinal extension of the tube-like means (1).

4. A laid-yarn fabric as claimed in claim 3, c h a r a c t e r i s e d in that the reinforcement threads (2) run in a zigzag pattern in the longitudinal extension of the tube-like means (1).

5. A laid-yarn fabric as claimed in claims 1-4, c h a r a c t e r i s e d in that the connecting thread system and/or the reinforcement threads (2) consists of a thermoplastic hybrid yarn.

6. A method of producing preforms for the manufacture of fibre composites according to which method a laid-yarn fabric is deposited on a core and is injected with thermosetting plastics, alternatively is heated, if the fabric is made from thermoplastic hybrid yarns, c h a r a c t e r i s e d by applying the laid-yarn fabric in the form of a transversely elastic, tube-like means (1) having reinforcement threads (2) inserted therein on the core by passing the tube-like means (1) over said core in such a manner that said tube-like means

(1), on account of its transverse elasticity, drapes itself closely about said core.

7. A method as claimed in claim 6, c h a r a c - t e r i s e d by applying at least two laid-yarn fabrics, both in the form of elastic tube-like means (1), the reinforcement threads (2) of which run at different angles to one another and at an angle to the longitudinal axis of the respective means (1), on top of one another such that the tube-like means (1) together form a multi-layer fabric wherein the reinforcement threads (2) of one of the tube-like means (1) cross those (2) of the other means (1) about the core.

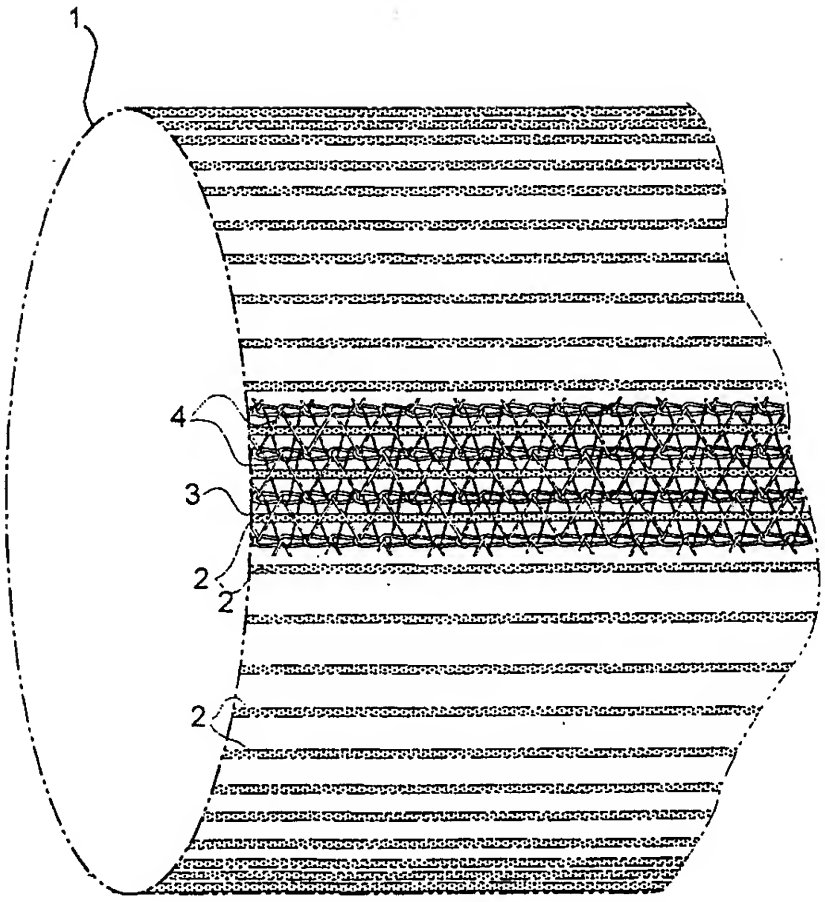

Fig. 1

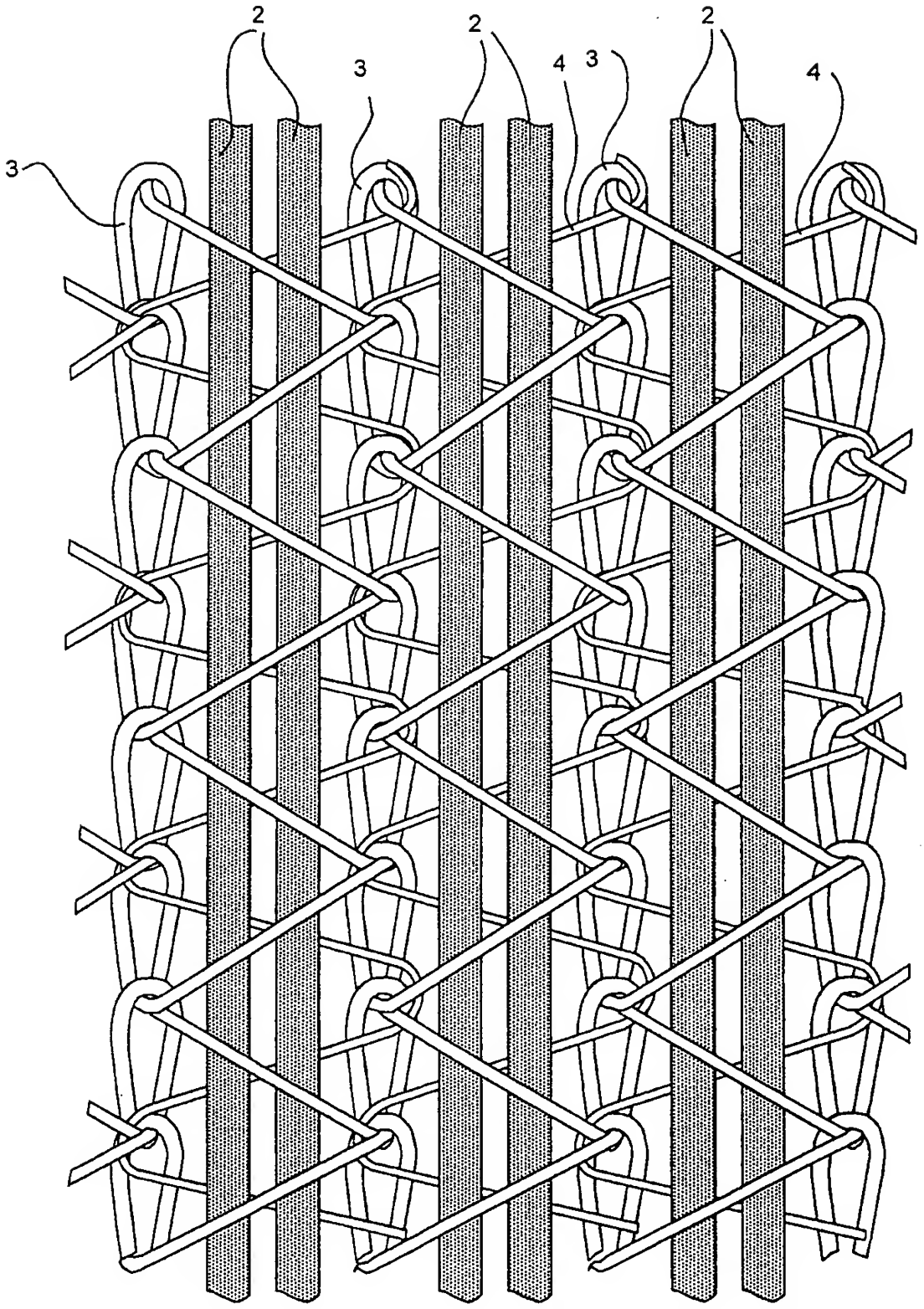

Fig. 2

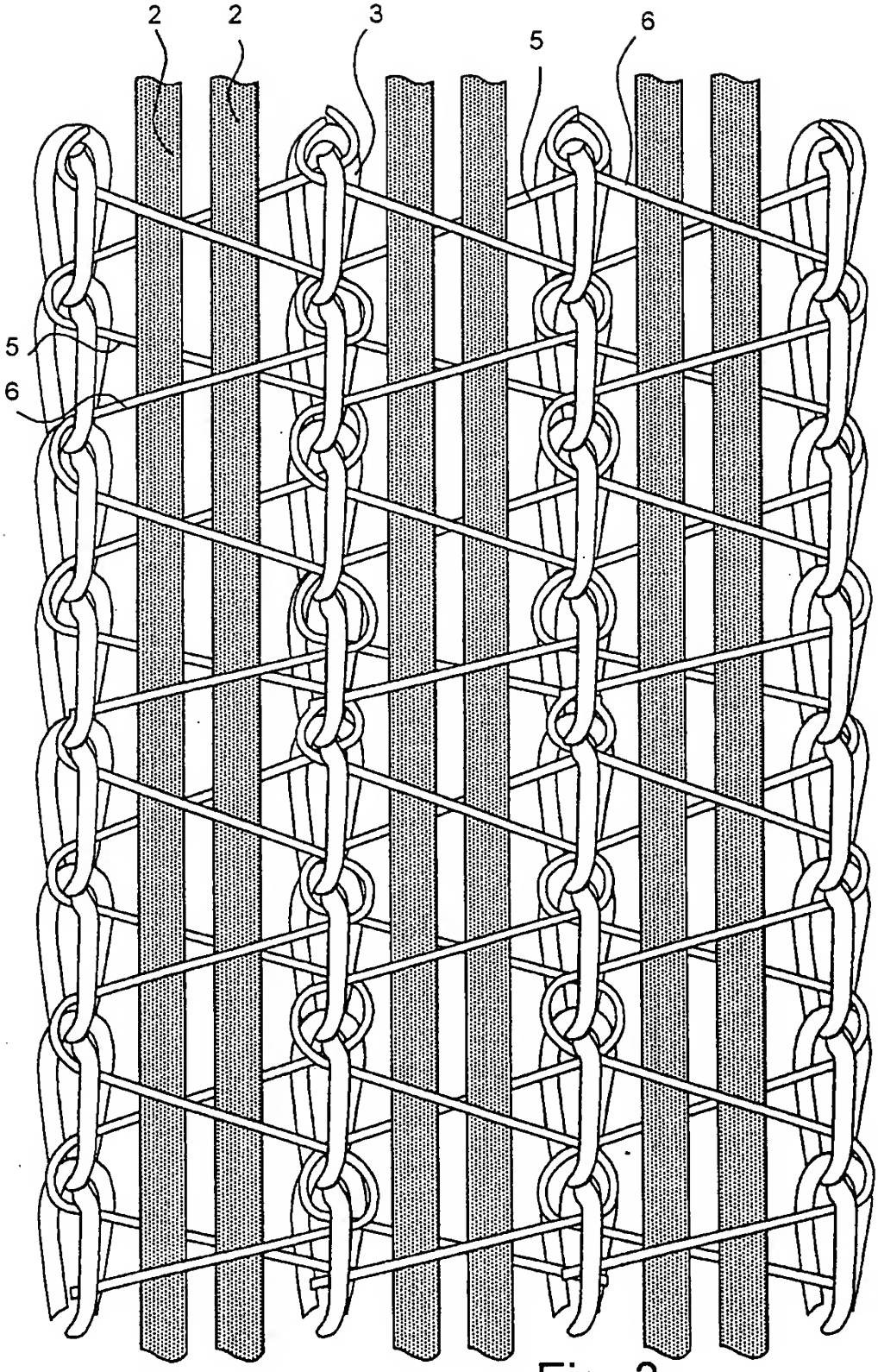

Fig. 3

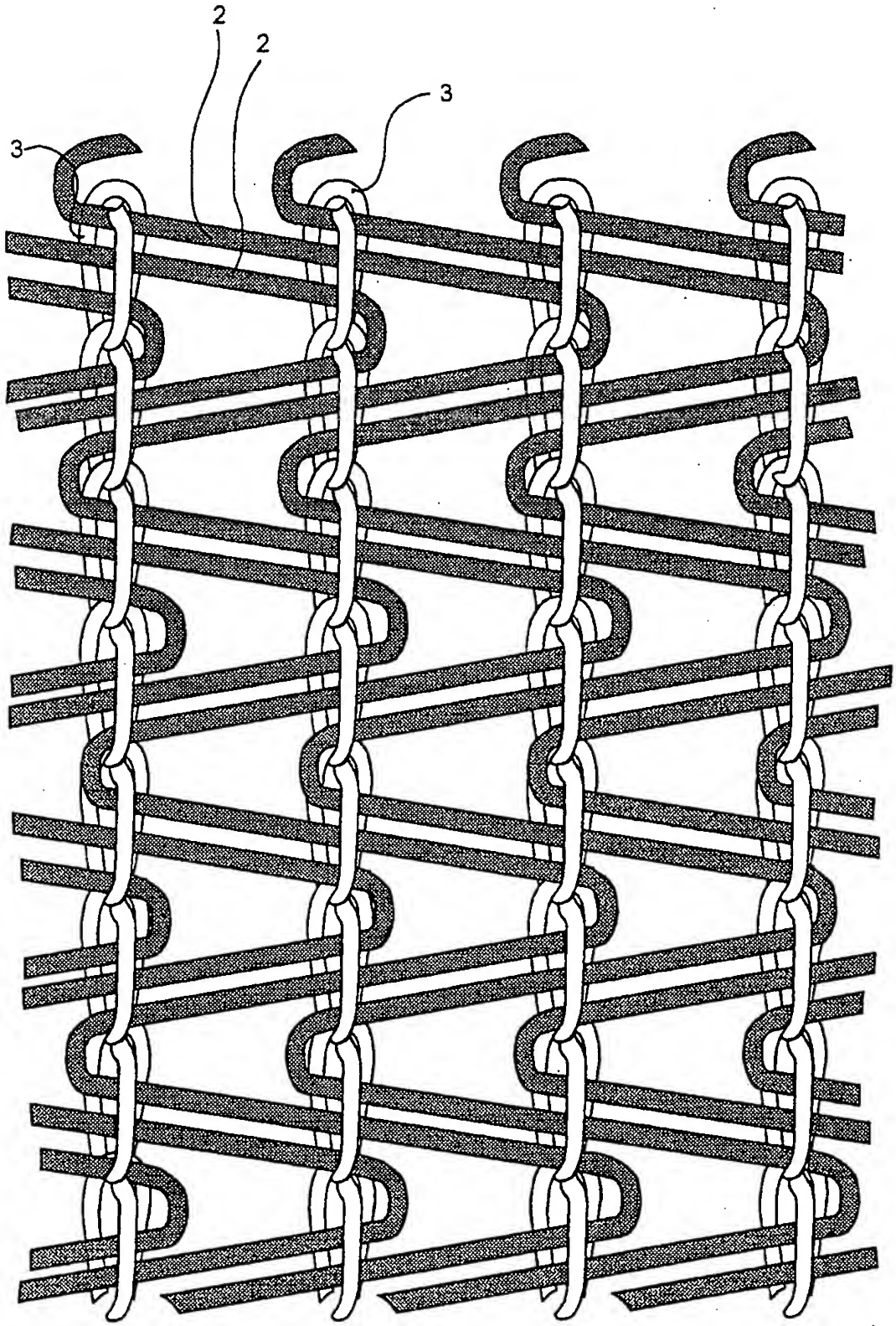

Fig. 4

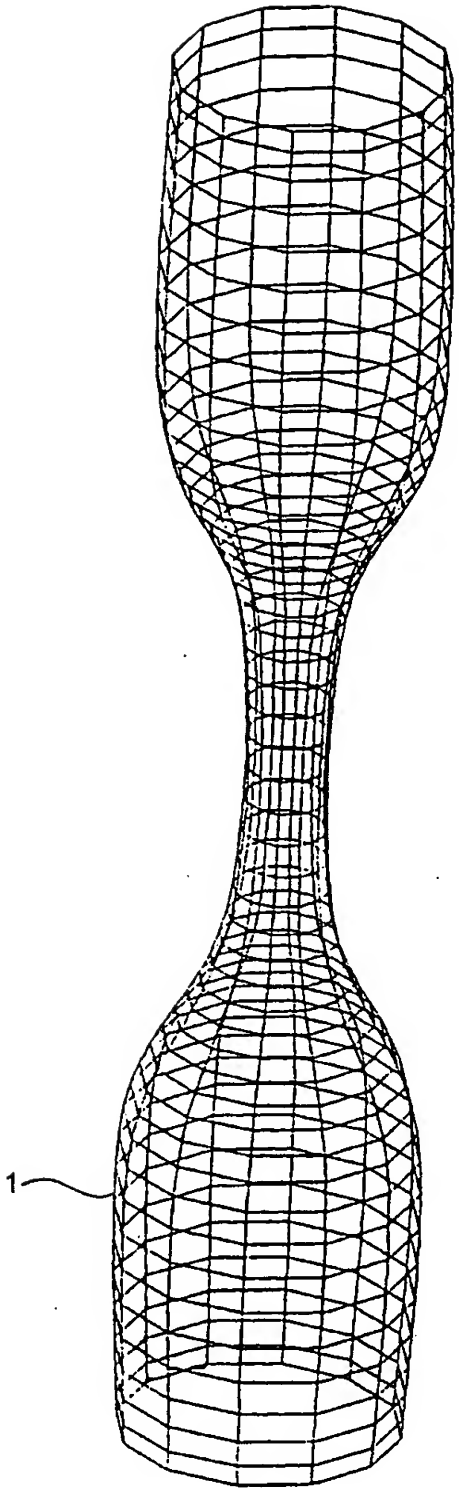

Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/00901

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D06C 3/00, B29C 70/02, B29C 70/16
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B29C, D06C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	US 3007497 A (S.M. SHOBERT), 7 November 1961 (07.11.61), figure 3 --	1,2,6
A	EP 0442092 A2 (MAN TECHNOLOGIE AKTIENGESELLSCHAFT), 21 August 1991 (21.08.91) --	1,2,6
A	US 4777859 A (W.A. PLUMMER, JR.), 18 October 1988 (18.10.88) --	1,2,6

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

International application No.
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